

Network Algorithms and Dynamics

ELEN E6909, Spring 2015
Mondays 1:10-3:40

- **Instructor:** Javad Ghaderi
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- **Prerequisites:** Probability, Elementary Stochastic Processes, Elementary Graph Theory, but more importantly, mathematical maturity and a level of comfort with reading and writing proofs.
- **Description:** This is the first offering of this course (as an special topics course). The course studies models, algorithms, and dynamics with focus on networked systems. The course covers various topics in network science, graph algorithms, random walks, epidemics, load balancing, etc. The topics will be selected from the list below:
 - (i) Mathematical models of networks: random graphs, the small-world phenomenon, power-law distribution, preferential attachment, etc
 - (ii) Graph algorithms: minimum spanning tree, matching, network flow problems
 - (ii) Dynamics: random walks, Markov chains, Ergodicity, long-run behavior, characterization of convergence rate to steady state, MCMC methods, spread of epidemics and opinions in social networks,
 - (iii) Other topics: server scheduling, load balancing, join the shortest queue, power of two choice, etc.
- **Textbook:**
 - *Epidemics and Rumours in Complex Networks* by M. Draief and L. Massoulié (Cambridge, 2009).
 - *Markov Chains, Gibbs Fields, Monte Carlo Simulation, and Queues* by Pierre Brémaud (Springer, 1999).
- **Grading:** based on homework assignments and course project